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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/806,388	03/23/2004	Keiji Hosotani	250922US2S	2356
22850	7590	01/23/2006	EXAMINER	
OBLON, SPIVAK, MCCLELLAND, MAIER & NEUSTADT, P.C. 1940 DUKE STREET ALEXANDRIA, VA 22314			PIZARRO CRESPO, MARCOS D	
			ART UNIT	PAPER NUMBER
			2814	

DATE MAILED: 01/23/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

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<b>Office Action Summary</b>	<b>Application No.</b> 10/806,388	<b>Applicant(s)</b> HOSOTANI, KEIJI	
	<b>Examiner</b> Marcos D. Pizarro-Crespo	<b>Art Unit</b> 2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 21 November 2005.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-8 and 21-28 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-8 and 21-28 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

Application/Control Number: 10/806,388 (Final Rejection)  
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Attorney's Docket Number: 250922US2S

Filing Date: 3/23/2004

Claimed Foreign Priority Dates: 3/18/2004 (JP 2004-077814)  
7/10/1003 (JP 2003-195187)

Applicant(s): Hosotani

Examiner: Marcos D. Pizarro-Crespo

### **DETAILED ACTION**

This Office action responds to the amendment filed on 11/21/2005.

#### ***Acknowledgment***

1. The amendment filed on 11/21/2005, responding to the Office action mailed on 8/23/2005, has been entered. The present Office action is made with all the suggested amendments being fully considered. Accordingly, pending in this Office action are claims 1-8 and 21-28.

#### ***Claim Rejections - 35 USC § 103***

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1-8 and 21-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsang (US 6864551) in view of Wallace (US 6143634) and Ramkumar (US 6677213).

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4. Regarding claim 1, Tsang (see, e.g., fig. 5A) shows most aspects of the instant invention including a magnetic random access memory comprising:

- ✓ A substrate **202**
- ✓ A transistor **210** having:
  - A gate electrode **215** formed on the substrate **202** via a gate insulating film
  - Diffusion layers **212/213** formed in the substrate **202**
- ✓ A first insulating film formed on the substrate **202** and the transistor **210**
- ✓ A multilayered interconnection **219** formed in the first insulating film
- ✓ A magneto-resistive element **11** formed above the first insulating film

Tsang, however, fails to show that the substrate is made of silicon and that silicon-deuterium bonds terminate some of the dangling bonds in the substrate. Ramkumar, on the other hand, teaches that deuterium passivation of dangling bonds in the substrate and deuterium introduction into the polysilicon gate electrode would improve Tsang's device function (see, e.g., col.9/ll.39-56). Ramkumar further shows forming (see, e.g., fig. 1) the transistor on a silicon substrate **12** via a gate-insulating layer **20**. Likewise, Wallace teaches that hydrogen passivating of the dangling bonds in a substrate improves device function (see, e.g., col.1/ll.10-15). Deuterium, an isotope of hydrogen, may also be used for passivating and being more stable than regular hydrogen it improves hot-channel-carrier lifetime (see, e.g., Wallace/col.1/ll.15-20). Wallace also forms (see, e.g., fig. 2) the transistor on a silicon substrate **200** via a gate-insulating layer **210**.

It would have been obvious at the time of the invention to one of ordinary skill in the art to use deuterium to passivate the dangling and to introduce deuterium into Tsang's gate electrode, as suggested by Ramkumar and Wallace, to improve the performance and the hot-channel-carrier lifetime of the device.

5. Regarding claims 2 and 22, Ramkumar shows silicon-deuterium bonds at an interface between the gate insulating film and the substrate under the gate, junction portions of the diffusion layers, and a channel portion (see, e.g., fig. 7 and col.7/ll.10-25).

6. Regarding claims 3 and 23, Ramkumar shows deuterium atoms in the first insulating film (see, e.g., fig. 7).

7. Regarding claims 4 and 24, Wallace teaches a high ratio of the silicon-hydrogen/silicon-deuterium passivated dangling bonds (see, e.g., col.1/ll.45-55).

8. Regarding claims 5 and 25, Ramkumar shows deuterium atoms in the gate insulating film (see, e.g., fig. 7).

9. Regarding claim 6 and 26, Ramkumar shows a second insulating film **38** formed on the silicon substrate including upper surface of the diffusion layers, and upper and side surfaces of the gate electrode, wherein the second insulating film contains deuterium atoms (see, e.g., fig. 6 and col.8/ll.38).

10. Regarding claims 7 and 27, Tsang shows that the magneto-resistive element **11** is electrically connected to the transistor **210** through part of the multilayered interconnection **219**, and that the transistor **210** is a data read switching element (see, e.g., col.2/ll.8-17).

11. Regarding claims 8 and 28, Tsang shows the transistor is a transistor of a CMOS circuit (see, e.g., col.7/ll.53).

12. Regarding claim 21, Tsang (see, e.g., fig. 5A) shows most aspects of the instant invention including a magnetic random access memory comprising:

- ✓ A substrate **202**
- ✓ A transistor **210** having:
  - A gate electrode **215** formed on the substrate **202** via a gate insulating film
  - Diffusion layers **212/213** formed in the substrate **202**
- ✓ A first insulating film formed on the substrate **202** and the transistor **210**
- ✓ A multilayered interconnection **219** formed in the first insulating film
- ✓ A magneto-resistive element **11** formed above the first insulating film

Tsang, however, fails to show that the substrate is made of silicon, a silicon nitride film containing deuterium atoms and formed on upper and side surfaces of the gate electrode, and that silicon-deuterium bonds terminate some of the dangling bonds in the substrate. Ramkumar, on the other hand, teaches that deuterium passivation of dangling bonds in the substrate and deuterium introduction into the polysilicon gate electrode would improve Tsang's device function (see, e.g., col.9/ll.39-56). Ramkumar also shows forming (see, e.g., fig. 1) the transistor on a silicon substrate **12** via a gate-insulating layer **20**. Ramkumar further teaches using a silicon nitride film **36** containing deuterium atoms and formed on upper and side surface of the gate electrode **22** such that deuterium atoms may be diffused across the device interfaces to passivated dangling bonds (see, e.g., fig. 4, col.3/ll.45-55, and col.7/ll.67). Likewise, Wallace

teaches that hydrogen passivating of the dangling bonds in a substrate improves device function (see, e.g., col.1/ll.10-15). Deuterium, an isotope of hydrogen, may also be used for passivating and being more stable than regular hydrogen it improves hot-channel-carrier lifetime (see, e.g., Wallace/col.1/ll.15-20). Wallace also forms (see, e.g., fig. 2) the transistor on a silicon substrate **200** via a gate-insulating layer **210**.

It would have been obvious at the time of the invention to one of ordinary skill in the art to use deuterium to passivate the dangling bonds of the substrate, to form a silicon nitride film containing deuterium atoms on upper and side surfaces of the gate electrode, and to introduce deuterium into Tsang's gate electrode, as suggested by Ramkumar and Wallace, to improve the performance and the hot-channel-carrier lifetime of the device.

### ***Response to Arguments***

13. Applicant's arguments with respect to the claims have been considered but are moot in view of the new ground(s) of rejection.

### ***Conclusion***

14. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

15. A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not

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mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

16. Papers related to this application may be submitted directly to Art Unit 2814 by facsimile transmission. Papers should be faxed to Art Unit 2814 via the Art Unit 2814 Fax Center. The faxing of such papers must conform to the notice published in the Official Gazette, 1096 OG 30 (15 November 1989). The Art Unit 2814 Fax Center number is **(571) 273-8300**. The Art Unit 2814 Fax Center is to be used only for papers related to Art Unit 2814 applications.

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Marcos D. Pizarro-Crespo** at **(571) 272-1716** and between the hours of 9:30 AM to 8:00 PM (Eastern Standard Time) Monday through Thursday or by e-mail via [Marcos.Pizarro@uspto.gov](mailto:Marcos.Pizarro@uspto.gov). If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy, can be reached on (571) 272-1705.

18. Any inquiry of a general nature or relating to the status of this application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair->



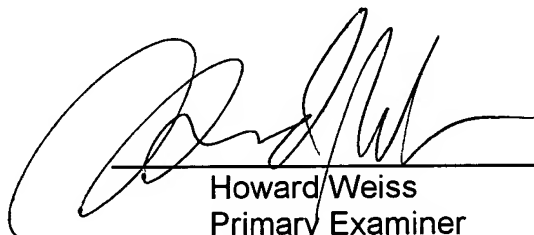
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19. The following list is the Examiner's field of search for the present Office Action:

Field of Search	Date
U.S. Class / Subclass(es): 257/421-427, 288-412	1/18/2006
Other Documentation:	
Electronic Database(s): EAST (USPAT, EPO, JPO)	1/18/2006

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